thirty miles from the supply depôt and then struggled on for a day with nothing but tea to maintain their strength.

The lecture closed with a description of the journey, to the northwest, of the Magnetic Pole party that located the Pole and came back to the sea only to find themselves faced by open water. They were living on seal meat and blubber when the explorer's steamer *Nimrod* fortunately picked them up.

The lecturer was frequently applauded and the favor of the audience was especially indicated when he displayed on the screen the British flag as it floated over the spot that marked his nearest approach to the South Pole.

At the close of his discourse, a reception was given to Sir Ernest, the ladies and gentlemen going forward to the platform where Professor Libby of Princeton introduced them to the President, who, in turn, presented them to the explorer.

SOURCES OF AMERICAN RAILWAY FREIGHT TRAFFIC*

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To understand the freight services of American railways one must have at least a general knowledge of the sources of traffic. The district and general freight agents and the traffic manager of any particular road must have detailed information concerning the territory served by their lines, and should also possess as broad a grasp as practicable of the resources and industries in all parts of the country. Unless the traffic official be thus equipped, he can hardly hope to serve his company efficiently. Likewise the transportation student, whether he be subordinate employee or executive official, who would so comprehend traffic problems as to be able to offer intelligent suggestions or to issue wise orders must know the transportation geography of his country.

This geographical knowledge necessary to a comprehension of American traffic problems and of the traffic policies followed by our

* See also the Author's Paper "Characteristics of American Railway Traffic: A Study in Transportation Geography," *Bulletin*, Vol. XLI, 1909, pp. 610–621.

railroad companies, like most valuable assets, is not to be gained without careful study. The vast size of our country, the varied character of its resources, the multiplicity of its industries, and the volume and range of domestic trade and foreign commerce require the transportation expert to enrich his mind with a wealth of detail, and to acquire the power of applying his information constructively to aid in the solution of any problem or in the interpretation of any situation with which he may be confronted. He must, of course, know much more than can be presented in this outline of the geography of American railway freight traffic; details must be filled in either by studying books upon economic and commercial geography, or by travel and personal investigation; or, preferably, by both methods.

The railway freight traffic, whose geography we are studying, is grouped by the Interstate Commerce Commission into seven general classes of commodities: products of agriculture, of animals, mines, forests, manufactures, and merchandise, to which is added a residual category including "other commodities." This classification of products shows roughly the extent to which our rail tonnage is drawn from industries connected directly with our basic natural resources—the farms and ranches, mines, and forests—and to what extent from manufactures, of secondary industries. It brings out the fact that, for 1908, fifty-three per cent. of the tonnage is made up of minerals (coal, coke, stone, sand, etc.), not including petroleum which is classed as a manufactured article; that manufactures—not counting in flour, which is credited to agriculture, nor packing-house products which are placed with animal products—now comprise 15.4 per cent. of the traffic; that lumber and other forest products, other than naval stores which are considered to be manufactures, amount to 11⅓ per cent. of the total; and that, despite our prominence in farming, agricultural products, grain and flour, cotton, hay, fruits, and tobacco, together with animal products, live stock, provisions, wool, hides and leather, aggregate less than eleven per cent. of the tonnage handled by the railroads.

Inasmuch as more than two-thirds of the tonnage consists of minerals and manufactures, the section of the United States where those commodities are most largely shipped will be the region making the heaviest contribution to rail traffic; and the portions of the country where grazing, farming, or even forest industries lead, will rank much lower in total tonnage. Indeed, in that relatively small part of the United States north of the Potomac and Ohio rivers and

east of Illinois and Lake Michigan—including only one-ninth of the land area of our country—where mining and maufacturing are most extensively carried on—more than one-half of the total tonnage of our railroads originates; whereas, the southeastern section lying east of the Mississippi and south of the Ohio and Potomac, although a prosperous region having once and a half the area of the northeastern district, and including the West Virginia and Alabama mines, its extensive pine and hardwood forests, and its broad cotton fields, ships only one-eighth of the total tonnage moved by our railroads. The remainder of the United States with 72½ per cent. (nearly three-fourths) of the entire land area, and, with the heavy ore shipments of northern Michigan, Wisconsin, and Minnesota and the bulky lumber traffic of the far Northwest to swell its total, creates less than one-third of the aggregate railroad tonnage. The major share of the freight traffic of our railways originates in a few sections of relatively small area, while over the larger part of the country the tonnage per mile of road and square mile of territory is comparatively small.

A closer view of the sources of our railway freight traffic can be gotten by studying in turn the southern, eastern, central, Cordilleran, and Pacific coast sections of the United States. It will be necessary to limit the study to a review of the principal resources and industries, to some consideration of the markets reached in domestic and foreign trade, and to a general analysis of the traffic of one or more typical railroads in each of the designated regions. It will be well to begin with the Southern States, or the southeastern and Gulf district instead of the northeastern section, because the economic activities of the South are less complex.

The raising of cotton has been the dominant industry of the South for a hundred years; and, although the utilization of mineral and forest resources is broadening the economic life, the growing of cotton and the use of the staple in manufactures now hold and will probably retain first rank. The rapid increase in the number and capacity of cotton mills in the South has latterly added strength to the industrial position of the cotton crop. The cotton belt, extends with widening area from Virginia to Texas and Oklahoma, and occupies the Piedmont of the Carolinas, Georgia and Alabama, the lower Mississippi Valley, with the exception of the lowlands along the Gulf, eastern Texas, most of Arkansas, and parts of Oklahoma, Tennessee and Missouri. This is the heart of the South, the home of most of its population, and, until the recent development of com-

merce and of iron and steel manufactures, it was the theatre of most of its economic life.

The tonnage supplied directly by the cotton crop, however, is not large; for the annual and immensely valuable yield of about 14,000,000 bales weighs only 7,000,000 tons, or about one per cent. of the total railway tonnage of the country; but a crop having a market value of $800,000,000 makes possible and necessary an active traffic in other goods into and out of the region where the crop is grown. Cotton culture directly and indirectly accounts for a large share of the traffic of the southern railways.

Of the 14,000,000 bales of American cotton somewhat more than one-third (5,000,000 bales), and a rapidly rising share, is worked up in our own mills; and the remainder is exported. Thirty years ago the chief center of the cotton production was in the Piedmont and in the other States east of the Mississippi; and in those days the largest interior market was Atlanta. Charleston and Savannah, as well as New Orleans and Mobile, were then important exporting gateways; but with the extension of the cotton belt into the States west of the Mississippi river, particularly into Texas, Houston has become the leading primary market, with Memphis, Fort Worth and Dallas also ranking high. Galveston has gained such a lead over other exporting points that, in 1907, her shipments abroad amounted to about three and a half million bales. New Orleans had second place with two million bales, and Savannah third position with less than one million. There was a short but probably temporary decrease in the cotton exports from Galveston and New Orleans, in 1908, due to the boll weevil.

The decline in rank of the South Atlantic seaports in the cotton export trade has, however, been due not only to the westward movement of the area of production, but also to the rapid rise of cotton manufacturing in the Piedmont section of North and South Carolina, Georgia, and Alabama—the four States in which most of the cotton mills of the South are located. The North Carolina mills require more cotton than is grown in the State; and those in South Carolina provide a market for nearly three-fourths of the home-grown staple. At the present time nearly two-fifths of the cotton spindles in the United States are running in the cotton-growing States, and most of the other sixty-two per cent. are in New England, Massachusetts still having nearly as many spindles as there are in the South; but the ratio is changing, the increase being more rapid in the Southern States.

This survey of the production and distribution of cotton shows that three changes are taking place in the cotton traffic of the southern railroads:—that the tonnage is rising with the rapid increase in the annual crop; that the railways in the western cotton states—those lines converging upon Houston, other Texas markets, and Memphis, and connecting these interior markets with Galveston and New Orleans, instead of the railways in the states east of the Mississippi river—have become the chief carriers of cotton; and that, while the shipments to the seaboard for export grow greater year by year, a larger percentage of the crop is being brought by rail to the mill towns in the Piedmont and by rail and coastwise steamers to the textile centers of New England. The manufacturing progress of the South is causing an increasing share of the raw cotton to be shipped to points within the South; while the shipments out of the Southern States to other parts of the United States and to foreign countries, mainly the Orient, are including a steadily enlarging volume of cotton goods.

Despite the fact that the South is chiefly engaged in agriculture, over half the railway tonnage consists of mineral products, chiefly coal, iron ore, petroleum, phosphate rock, and building materials, coal holding first place. The most productive coal field south of the Potomac and Ohio is the one lying mainly in West Virginia and extending into Virginia, Kentucky, and Maryland. From this district is taken about seven-ninths of the coal mined in the South, some of it being shipped by water down the Kanawha river, but most of it by rail, in part to western markets and more largely to the Atlantic seaboard for further distribution. The output of the rich Alabama field, now one-sixth of the southern coal, is chiefly used locally in the Birmingham iron industries, but is also shipped to other interior markets in the South, as well as to the Gulf ports. It is expected that the Panama Canal will increase the shipment of Alabama coal to and beyond the Gulf seaboard. Kentucky and Tennessee find ready markets for their tonnage within or not far beyond their borders. Texas has some coal, and more is obtained in Missouri, Arkansas and Oklahoma. Taken as a whole, the coal traffic of the southern railways has numerous sources and moves thence in all directions. It is increasing rapidly with the industrial progress of the South.

The all-important iron ore district of the South is close to Birmingham, Ala., where about two-thirds of the southern ore is mined; the other third coming mainly from Tennessee, Virginia and Georgia. The Alabama ore is smelted close to the mine mouth,

and that of the three other states requires but short hauls to reach the furnaces. The iron ore traffic of the southern railways is relatively unimportant in comparison with the tonnage of this commodity handled by the roads in Pennsylvania and about the Great Lakes where most of the crude iron, amounting to more than four-fifths of the total output of the country, and to seven times that of the South, is moved long distances, most largely by joint rail and water routes, but also to some extent by all-rail transportation.

During recent years the southern, and what are usually named the southwestern states have become the source of nearly forty per cent. of the petroleum secured from American wells. Formerly the oil was obtained almost entirely from the northern Appalachian district; later the so-called mid-continent field lying mainly in Oklahoma, and extending somewhat into Kansas and northern Texas, had the largest output; now California comes first, and the Appalachian section third. Three-fifths of the petroleum output of the southern and southwestern states in 1908 came from Oklahoma, and the remainder mainly from Texas, Louisiana, and West Virginia.

As is well known, most of the crude petroleum is transported by pipe lines or by pipe line and tank steamer to the refineries where illuminating oil is prepared, or to the storage tanks of fuel oil; but tank cars as well as pipe lines are used especially in the Louisiana, Texas and California fields. The oil tonnage of the railways is made up chiefly of the refined products which are handled chiefly in bulk in tank cars, although much is shipped in barrels. Many of the numerous by-products are necessarily put into cases or packages for shipment, The services performed by the railroads in transporting oil consist principally of connecting the refineries with the many thousand places where petroleum products are retailed.

The phosphate rock now mined in the United States, amounting to 2,386,000 tons in 1908, is secured from beds in Florida, Tennessee, and South Carolina. The Florida rock, which is two-thirds of the total, is taken from the western part of the central portion of the peninsula, and is shipped as crude rock from Port Tampa mainly to foreign countries. The greater part of the Tennessee output is sent to various parts of the United States for domestic consumption, about one-sixth being exported by way of Pensacola, Norfolk, and Newport News. The South Carolina beds are near Charleston, and the crude rock there obtained is worked up into fertilizers which are distributed widely within and beyond the United States.

The other large source of the traffic of the southern railways—

and it is outranked in tonnage only by coal—is the forests. The forests of the Southern States, which now far surpass the other lumber-producing sections, the northeastern, the Lake States, and the Pacific slope, in the value and quantity of the annual cut, include two separated areas—the yellow pine belt paralleling the Atlantic and Gulf, from North Carolina to Texas and reaching north into Arkansas, and the hardwood belt covering the Appalachian mountains and extending across the states lying to the west-northwest of the mountains. From these forest sources, a fifth of all the tonnage of the southern railways is secured. The pine belt has the larger output, the leading states being Louisiana and Mississippi, but all the Gulf States make large contributions to the total; while Georgia, North Carolina and Virginia are also drawn upon heavily. Practically all of the larger Gulf and south Atlantic seaports have heavy lumber shipments, a part of the product, particularly that of the Gulf ports, being exported while the major share is shipped coastwise for domestic use. An important feature of the rail traffic of the South is the transportation of large tonnages of lumber from the interior to the seaboard.

The great center of the hardwood lumber industry is Memphis. Tennessee stands eighth among the Southern States in value of lumber products; but Arkansas ranks third and Mississippi second. The railroads converging upon Memphis from Tennessee, Arkansas, and northern Mississippi transport large quantities of timber and rough lumber and make that a great milling district, from which the finished product is shipped over a wide territory. Kentucky and West Virginia each produce more lumber than Tennessee does, the output of these States now being marketed, in large part, north of the Potomac and Ohio.

The traffic of the railways in the *northeastern section* of the United States includes such a great variety of commodities and is drawn from so many sources that a discussion of its origin must avoid detail. It will be convenient to consider the northeastern section to include the states north of the Potomac and Ohio and east of Illinois and Lake Michigan; i. e., the first three of the ten territorial groups into which the Interstate Commerce Commission divides the United States in tabulating the mileage, financial and traffic statistics of the railways. By giving these limits to the northeastern section, Ohio, Indiana, and the southern peninsula of Michigan are associated with the East instead of the Central West; but this grouping is fully justified by the close connection of these

trans-Allegheny states with the industrial activities and commerce of the middle and New England States.

The large volume of railway freight in the northeastern district, while derived from many sources and composed of a great variety of commodities, consists mainly of four kinds of traffic: (1) Anthracite and bituminous coal, (2) iron ore and steel products, (3) manufactures of many kinds, especially textiles and machinery, and (4) the export and import trade. By considering the sources and routes of these four classes of traffic we shall account for the greater share—probably four-fifths—of the railway tonnage of this part of the United States.

The coal shipments far exceeed any other class of traffic in tonnage. Nearly half of the tonnage and more than half the value of all the coal mined in the United States is secured in Pennsylvania (200,000,000 tons in 1908); and above six-tenths of the total is from Pennsylvania, Ohio, Indiana and Michigan. Somewhat over one-third of the Pennsylvania coal consists of the anthracite secured from three small areas east of the Allegheny mountains. This coal, both anthracite and bituminous, is distributed generally over the northeastern section of the United States, and is handled mainly by the railroads, the principal exceptions being the shipments coastwise north from Norfolk, Newport News, and Philadelphia, the shipments out of this northeastern part of the United States to the north central section by way of the Great Lakes, and the barging of coal down the Ohio and Mississippi rivers. The great industrial centers, such as the Pittsburg district, and Cleveland, and the metropolitan Atlantic seaboard cities, are the chief centers towards which the coal moves from the northern Appalachian field.

The mineral traffic, comprising nearly six-tenths of the total railway tonnage of the northeastern section, consists mainly of coal, coke, and iron ore. The iron ore is derived in part from the mines of New York, Pennsylvania, and New Jersey and a small amount is imported; but the chief sources of supply for the furnaces and mills of the northeastern states, in which most of the iron manufacturing of the United States is done, are the mines of northern Minnesota and upper Michigan, which are brought close to Ohio, Pennsylvania, and New York by cheap transportation on the Great Lakes. The ore traffic from the Lakes to the furnaces, and shipments of iron and steel and the manifold manufactures thereof from the mills to all parts of the country comprise a volume of freight second in tonnage only to that created by coal and coke.

It is the manufacturing activities of the northeastern states which directly and indirectly account for the heavy railway tonnage of that region. These industries are not only of great variety, but are generally distributed over the larger part of the district; and while railway traffic is largest in such industrial sections as central Indiana, eastern Ohio and western Pennsylvania, southeastern Pennsylvania, northern New Jersey, southeastern New York, and southern New England, the manufactures of other parts of the northeast give rise to no small rail tonnage. Without attempting to enumerate even the more important classes of manufactures, other than iron and steel, mention may be made of machinery and tools which are made in many parts of the section under consideration; of the ship-building plants on the Great Lakes and along the Atlantic seaboard; and of cotton, woolen and silk textiles whose mills are located chiefly in the region extending from Portland, Me., to Philadelphia. All of the cotton and silk, and nearly all the wool, used in the textile mills are brought from a distance; and the fabrics and carpets are marketed in every part of the United States, and to some extent abroad. The tonnage of rail traffic directly created by the textile industries is not large; but the concentration of population necessitated by these industries results in a great enlargement of the freight and passenger business of the railroads.

The major share of the foreign trade of the United States, both export and import, being handled through the north Atlantic ports, our foreign commerce contributes an important part of the traffic of the railroads connecting the Mississippi Valley with the seaboard from Portland to Norfolk. The export tonnage, which greatly exceeds that of the imports, formerly consisted mainly of the results of agriculture; but, while the products of our farms—cotton, cereals, fruits, animals, and animal products, etc.—still account for about six-tenths of the value of the commodities we sell abroad, our exports are steadily becoming more diversified with the progress of our manufactures, particularly those of iron and steel which now contribute one-tenth of the total value of our foreign sales.

The export shipments from the United States are more evenly distributed among our several seaports than are the imports; nevertheless one-third of the outbound commerce passed through New York; while Baltimore, Boston and Philadelphia, although outranked by Galveston and New Orleans, handle one-sixth of the exports. Much more than half of our outgoing foreign trade moves through the ports on the Atlantic coast north of Hampton Roads—the ports reached by the trunk line railroads.

The import traffic is more concentrated than are the export shipments. Six-tenths of all our imports enter via New York; and more than three-fourths of the total are brought in through the four largest North Atlantic ports. The commodities imported are of great variety, and consist largely of high class traffic; they are distributed generally over the country, and their transportation is eagerly competed for by the railroads of the northeastern section.

Railway traffic in the *Central West,* that section lying between Indiana and Lake Michigan on the east and the Rocky Mountains on the west, has a higher percentage of products of agriculture than does any other large subdivision of the country. This is the center of the cereal production in the United States, and is the district leading in the value of farm animals. Its principal railroads are popularly called the "granger lines."

These roads converge mainly upon four great centers (there are numerous more local foci), the greatest center being Chicago, or, more broadly considered, the southern and western shore of Lake Michigan. Minneapolis on the Mississippi, the great milling city, and Duluth and Superior, the transfer points at the head of Lake Superior draw to them a large traffic from the upper portion of the central west; while St. Louis, noted for its manufactures and jobbing trade, and Kansas City and Omaha, second only to Chicago in packing-house products, are the two great traffic loci in the southern part of the central west.

But large as is their traffic in grain, animals and animal products, the railways of the central west have a greater tonnage of minerals. Illinois with its 48,000,000 tons of annual output (1908) ranks second among the coal-producing states, while Iowa and Kansas with a combined production of 13,000,000 tons stand ninth and tenth in the list. Eight-tenths of the iron ore of the United States comes from the three states in the Lake Superior district, and while most of this ore is taken by a short rail haul to Lake Superior, it none the less swells the tonnage of the railroads. The mineral traffic of the railways of the central west, mainly coal, iron ore and copper has a tonnage more than double that of agricultural commodities, animals and animal products.

While in the central West, as a whole, manufactures are as yet relatively undeveloped, there are certain sections and numerous cities in which manufacturing is carried on so extensively as to cause the railroads serving them to transport a large tonnage of mill and factory products. Illinois, with its rich coal fields, with

the cheap lake transportation to it from ore mines of the Superior district, with its population of nearly 6,000,000, and its great metropolis of Chicago stands third in the list of manufacturing states. Missouri ranks seventh and Wisconsin ninth. Portions of these three states and some sections of the other commonwealths of the central west have become the home of a large variety of industries whose products are marketed generally over the United States and to a surprising extent in foreign countries.

At the southern end of Lake Michigan is an especially favored location for manufactures. Water-borne ore and near-by coal are brought together cheaply, while more than a score of railroads bring hither, over their converging lines, the natural products of the central west and take hence to all points of the compass the output of mill and factory. Like the Pittsburg district and the section along the south shore of Lake Erie, the Chicago district, within which may properly be included the new city of Gary, Ind., occupies a strategic position industrially, and its rapid progress is creating a vast railway traffic in non-agricultural commodities. A similar influence is being exerted by Milwaukee, Minneapolis, Duluth, St. Louis, and other cities. The traffic of the railways in the upper half of the Mississippi Valley is rapidly becoming diversified, as it flows into and out of an increasing number of industrial centers.

This productive middle portion of the United States located centrally within a broad continent, from 500 to 1,500 miles from the ocean has a surprisingly large volume of trade with our seaboard states and with foreign countries. Highly efficient railroad lines connect it with the Atlantic, the Gulf and the Pacific. Formerly, the Atlantic roads and the lakes carried out most of its exports which consisted chiefly of products of the farm; but now the Gulf route is taken by a large percentage of the cereals, and the Pacific lines also share in the outbound flour and provision tonnage. Meanwhile, the growth of population in the central west, the opening of its coal and iron mines, and the development of its manufactures, have lessened the importance of its exports of agricultural products, have enhanced the volume of manufactures—agricultural and mining machinery, engines, iron and steel, both crude and wrought into wares of many shapes and uses, vehicles of all kinds, etc.—and have enlarged the volume and variety of the commodities brought into the section from other parts of the United States and from abroad. In consequence, the trains that now take the products of the central west to the Atlantic and Pacific return with a profitable

"backload;" and though this can not yet be said of the roads to the Gulf, the northbound traffic is increasing, and will grow more rapidly with the opening of the Panama Canal and with the progress of our trade in Latin-American countries.

In the *Rocky Mountain section,* railway tonnage must always be less than in other parts of the country; although it is probable that most persons underestimate the traffic possibilities of the mountainous and arid West. At the time of the construction of the earlier Pacific roads, the great Cordilleran plateau was regarded mainly as a barrier to be surmounted to reach the traffic of the Pacific coast; but now the interior traffic sources are recognized to be of greater importance. Prosperous roads like the Denver and Rio Grande have depended mainly upon local rather than upon through traffic; and at the present time the northern transcontinental lines derive the larger share of their profits from the traffic of the places along their lines. This is probably not yet true of the southern lines to the Pacific, but even they are prospering increasingly because of the growth of local business.

The internal sources of traffic are the mines, ranches, irrigated districts, and the trade of such collecting and distributing centers as Denver, Salt Lake City, Cheyenne, Helena, Spokane, Albuquerque, El Paso, etc.

Coal naturally leads other minerals in the volume of tonnage; and one sure evidence of the industrial progress of the mountain States is the increase in the amount of coal mined, which has doubled in ten years. Colorado ranks eighth among the coal-producing States and Wyoming twelfth. Five per cent. of the coal mined in the United States, and one-tenth of that secured outside of Pennsylvania, comes from the Rocky Mountain States, not including those on the Pacific coast. More than two-thirds of our copper is mined and smelted in the Cordilleran States, mainly in Arizona, Montana and Utah, the only important copper state outside of this section being Michigan, from which one-fourth of the total output is secured. The mining of gold, silver and lead. likewise, gives rise to an important share of the rail traffic of the mountain district. The mining camps are distributed generally among the Cordilleran States, Colorado holding first place in the output of gold and silver and in the total production of minerals.

The ranches are the second source of the traffic of the railroads in the Cordilleran section. The eight States and territories comprising most of the Cordilleran plateau, Montana, Wyoming, Colo-

rado, New Mexico, Arizona, Utah, Nevada, and Idaho, contain nearly half of all the sheep in the United States; and if the three Pacific coast States, which are largely within the mountain district, be included, the sum is over three-fifths of the total for the country. Montana and Wyoming lead all the other States in number of sheep. The number of cattle in these mountain commonwealths, while not equal to those on the Texan ranches or the farms of Iowa and other Mississippi Valley States, is none-the-less large, amounting to about one-sixth of the total for the United States.

It is, however, the development of irrigation that promises most for the growth of the rail traffic of the mountain States. Such highly fertile sections as the Salt Lake Valley in Utah, the valleys of the Salt River and other streams of southern Arizona and New Mexico, the Imperial Valley of southern California, the Truckee-Carson district of western Nevada, the Uncompahgre Valley of western Colorado, and the irrigated portions of Wyoming, Montana, Idaho, and eastern Washington, these are to be the home of several millions of people and the sources of large railway traffic. The irrigation of those districts in the arid west to which water can be supplied is as yet only well begun; and while the irrigable sections comprise only a small percentage of the total area of the great West, the presence of these highly productive and thickly populated valleys scattered over the wide Cordilleran territory will require an increasing railway mileage and traffic.

Nothing more clearly indicates the increasing railway traffic of the mountain section than does the growth of such cities as Denver and Salt Lake City. Each place is the center of converging and radiating railway systems that unite it not only with the Pacific coast and the Mississippi valley, but also with most parts of the Cordilleran region. These cities and numerous other lesser, but growing, intramontane railway and population centers evidence most clearly the economic progress of the West.

The chief sources of railway traffic in the *Pacific Coast States* are the forests, the grain fields, the fruit farms, the ranches and the mines, and the inshore and deep-sea fisheries. The Alaskan trade and the growing business with the Orient and Mexico are other, though minor, sources. The products from these sources are in part shipped by sea to the Atlantic and across the Pacific; and in larger volume eastward by rail to markets in the Cordilleran, central and eastern sections of the United States. The Pacific seaboard States, which formerly had little commercial intercourse with

other parts of the country, now outrank all other sections in the width of the range of their commerce. The past development of these States has been rapid; but their future growth, aided by the large number of transcontinental railroads in service or nearing completion, by the enlarging markets in the mountain States, by the cheaper transportation by way of the Panama Canal to the American and European Atlantic seaboards, and by the steady tide of immigrants from Europe, will be even more phenomenal. It is easy to understand why so much capital is now being spent in adding new Pacific lines. The St. Paul was finished in 1909, the Western Pacific from Salt Lake to San Francisco, and the Kansas City, Mexico and Orient to the west coast of Mexico will soon be in operation.

The lumber from the magnificent forests of Washington, Oregon and northern California, is the largest single item of railway tonnage. The market for this lumber is no longer confined to places reached by water carriers, but includes the entire western part of the United States, and, for the most expensive grades, the Eastern States. The rates eastward from the great Northwest are especially low, because lumber is largely handled as a "backload" in cars that would otherwise run empty. Washington is now the leading lumber state, its output being one-twelfth of that for the entire country.

The production of wheat in California and Oregon has declined during recent years with the substitution of intensive for extensive farm cultivation; but in Washington the annual crop is still increasing, that state now ranking sixth in wheat production. All three states are growing increasing amounts of barley, the other important cereal crop of the section, California now having a long lead over all other states in barley production.

In southern California, and in portions of central California, and Oregon, the orchards and vineyards originate the major share of the rail tonnage. The California green fruits are now sold in a well-organized market that includes the entire United States; her canned and dried fruits, wines, raisins, olives, olive oil, and almonds have an even wider sale. Horticulture and viticulture, are the chief sources of wealth in California, and in parts of Oregon. The present large shipments of green and prepared fruits will undoubtedly increase more than proportionally with the growth in the population of the United States. Furthermore, the development of the Pacific coast states in fruit production means that they will have sections containing relatively closely settled communities of prosper-

ous people and the rail traffic, inbound, as well as outbound, will consist largely of high-class, profitable freight.

While California has long since ceased to be preeminently a mining and grazing state, it is second only to Colorado and Alaska in the output of gold, unless, perchance, the mines at Goldfield may have now given Nevada the third place. California is now the ranking State in the output of petroleum, and the market value of the 45,000,000 barrels of this mineral annually obtained from the California wells is nearly equal to the value of the gold yearly mined. For industry and commerce, the petroleum is far more important than the gold. It is used instead of coal in the locomotives, and to a large extent in stationary engines; and it constitutes one of the larger items of railway traffic in the state.

Washington is the only one of the Pacific coast states that has coal enough to be of commercial importance, and its mines have an annual output of less than 4,000,000 tons. The mines of Vancouver, which yield two and a half times this quantity and a product of better quality, are the chief source of the coal used on the Pacific coast. The Vancouver coal, however, is mainly distributed by water and contributes but little to the tonnage of American railways.

The grazing industry in the Pacific coast states, particularly in Oregon and California, is important, although the ranches are giving place to farms. For some time to come, California and Oregon will have surplus wool, sheep and cattle for shipment to other states.

The fisheries of the Pacific coast states and Alaska yield an annual product worth $17,200,000, and constitute an important industry. The salmon catch accounts for over two-thirds of the total value, and formerly this had its chief centers in the Columbia River and the tributaries of Puget Sound, but now the waters of British Columbia and Alaska are more productive, the value of the Alaskan salmons being more than double that derived from the waters of Washington and Oregon. The trade in this fish, both fresh and canned, including the Alaskan product, is handled through the ports of our west coast states, from whence it is distributed generally over the United States.

The rapid growth of the export and import commerce handled at the Pacific ports of the United States has contributed largely to the tonnage and earnings of the transcontinental lines, for the reason that a large share of the exports are brought from the farms of the upper Mississippi Valley, the cotton mills and plantations of the South, and the manufactories of the central West and the East. To an even larger degree, the imports are carried over the Rocky Moun-

tains by rail for distribution throughout the central and eastern sections of the country. This traffic with trans-Pacific countries is large enough to have caused most of the transcontinental railway companies to operate lines of steamers connecting their Pacific ports with the Orient.

The railways that serve our western tier of states derive their traffic from numerous sources; and the indications are that each of the main sources—the industries of the states themselves, the markets of the Cordilleran section, the maritime trade with Mexico, Canada, Alaska, Hawaii, the Orient, and Australia—will contribute an increasing volume of traffic for movement within the Pacific coast states, and across the mountains—to and from the eastern half of the United States. The western railroads have passed the period of doubtful experiment; they rest upon a sure traffic foundation.

The general facts brought out in the foregoing brief survey of the main sources of traffic in the five large physical subdivisions of the United States may be illustrated and their effects noted by a summary tabular analysis of the principal classes of *commodities handled by typical railroad systems* located in different sections of the country. The data presented in the following table are taken from the annual reports of the carriers. The grouping of commodities is that required by the Interstate Commerce Commission.

CLASSIFICATION OF FREIGHT TONNAGE OF TYPICAL RAILROADS
1908

	PENNSYLVANIA RAILROAD CO.	CHESAPEAKE AND OHIO	SOUTHERN RAILWAY	CENTRAL OF GEORGIA	ST. PAUL	ROCK ISLAND LINES	SANTA FE
Total tonnage.....	182,083,103	16,540,833	26,654,389	4,700,841	26,189,853	15,877,646	16,610,910
	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT.
Products of Agriculture.....	5.94	4.56	11.04	22.39	21.537	26.37	22.88
Products of Animals..	1.78	.69	1.22	1.41	6.894	7.92	7.92
Products of Mines....	65.45	70.79	38.77	24.93	28.518	27.82	32.05
Forest Products.....	4.78	10.27	17.76	19.11	12.944	12.26	12.41
Manufactures	18.51	5.99	} 31.21	} 32.16	17.267	17.92	17.95
Merchandise.....	.77	3.18				6.87	} 6.79
Miscellaneous.....	2.77	4.52			} 12.840	.84	
TOTAL.....	100.00	100.00	100.00	100.00	100.00	100.00	100.00

The sources of the tonnage and the traffic differences of the lines listed in the table are clearly evident. The Central of Georgia, located in the heart of the cotton belt of the South, the Saint Paul in the upper Mississippi Valley, the Santa Fe, and the Rock Island roads in the central and southwestern trans-Mississippi section—the last three systems extending throughout the wheat and corn districts —have a far larger percentage than the other systems do of traffic in agricultural products. Their tonnage of products of agriculture is second only to, and not greatly less than that of mineral products; while the percentage of animal products, in the case of the St. Paul, Rock Island and Santa Fe is from five to ten times that of the other roads.

The percentages for mineral traffic are especially instructive. On all the seven systems, even the two "granger" lines and the transcontinental road, the minerals have a greater tonnage than does any other class of commodities; while on the Chesapeake and Ohio, a prominent soft coal carrier, the mineral percentage is nearly seventy-one. It is evident that the Pennsylvania Railroad, which is the greatest freight carrier in the world, must serve the principal mining and manufacturing section of the United States; 65.45 per cent. of its tonnage consists of minerals, which, together with the manufactures, comprise almost seven-eighths of the company's vast freight traffic. Its coal and coke shipments alone exceed 105,000,000 tons.

The lumber traffic is relatively greater on the two Southern roads than on the others included in the table, because of the large output of the pine and hardwood forests of the Southern States. One-eighth of the tonnage of the "granger" roads and the Santa Fe is lumber, this large traffic being due to scarcity of timber in the prairie states, which are obliged to secure nearly all of their lumber from a distance.

The percentage of manufactures in the traffic of the southern and western railroads is a significant fact. Roads located as the Pennsylvania is will naturally have a maximum tonnage of manufactures, and a coal road, like the Chesapeake and Ohio, a minimum; but the systems which serve regions whose industries until recently, were almost exclusively agricultural, report their tonnage to contain a relatively large percentage—and it is an increasing one—of manufactures. While there are conspicuous instances of the concentration of certain industries in specially favored localities, the evolution of industry in the United States is spreading mills and factories

generally over the country. Cheap and efficient railway transportation makes possible the concentration of industry when that is most economical, and it also enables manufactories to be started in hundreds of places where they otherwise could not exist. The progressive diversification of industry throughout the United States is enriching the tonnage of the railroads with an enlarging percentage of the higher and more profitable classes of freight and is establishing a broader and more stable traffic basis for all our railway systems.

DETERMINATION OF THE HEIGHT AND GEOGRAPHICAL POSITION OF MT. McKINLEY

The Society is indebted to Superintendent Otto H. Tittmann of the U. S. Coast and Geodetic Survey for an advance copy of the Report made to him on a determination of the height and geographical position of Mt. McKinley. This work was done as an incident in the survey of Cook Inlet, on which the Survey is at present engaged. The Report, which is signed by Mr. William Bowie, Chief of the Computing Division, is as follows:

"I have the honor to report that the computation and adjustment of the horizontal and vertical angles to determine the geographic position and elevation of Mt. McKinley, Alaska, have been completed. The resulting position for that mountain, on the Valdez Datum, is

N. Latitude	63°	03′	56.83″
W. Longitude	151	00	41.31

The Valdez Datum is based upon the value of the longitude at the astronomical station in the town of Valdez and the mean of the latitudes observed at three astronomical stations in Prince William Sound, Alaska, and is the datum upon which are based the Coast Charts between Cape St. Elias and the Alaskan Peninsula.

"The resulting elevation of Mt. McKinley above mean sea level is 20,300 feet.

"The above position was obtained from the adjustment of horizontal directions observed from four stations of the Cook Inlet triangulation, three of which were occupied in 1909, while one was occupied the previous year. All of the observations were made by the party under Assistant H. W. Rhodes, commanding the U. S. Coast and Geodetic Survey Steamer McArthur. The angle subtended